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THERMOANALYTICAL CHARACTERIZATION OF SEVERAL ANTARCTIC
METEORITES WE054941

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Following our first attempts to get thermoanalytical data for
a number of meteorites [cf. Lang et al., 1981] we focused our at-
tention on several meteorites from Antarctica: 5 achondrites,
2 chondrites and 1 iron. Received from the National Institute of
Polar Research Tokyo they were:

achondrites : Yamato-74010, diogenite
Yamato-74013, diogenite
Yamato-7308, howardite
Yamato-74450, polymict eucrite
ALH-765, polymict eucrite

chondrites : Yamato-75102, L 3
Yamato-74662, C 2

iron : DRP-78007

We realize that our few data [cf. Lang et al., 1983, 1985;
Žbik et al., 1984] are too preliminary and scarce to offer any
valuable conclusions. The reported here few observations are ex-
pected to be useful in the future research of Antarctic meteor-
ites including thermoanalytical study.

The thermochemical response to heating in air is observed dis-
tinct on the differential thermal /DTA/ and thermogravimetric
/TG/ curves. However, within the heating range up to 1000°C exo-
thermic peaks from oxidation are often seen on the DTA-curves ac-
companied by a mass increase on the TG-curves. Our experience
suggests that in meteorites remarkable oxidation events are due
- in the first approximation at least - possibly to iron. Wüstite
FeO can be obtained from conversion of free iron or decay of ni-
ckel-iron to be further oxidized to magnetite Fe_3O_4 or even hema-
tite Fe_2O_3 . The final possible oxidation of free iron to hemati-
te results in mass increase of ~43%. The intermediate steps lead-
ing to ultimate oxidation of iron can eventually be seen on the
DTA-curves as more or less resolved exothermic peaks.

Assuming an extremely simplified model of oxidation of iron
to hematite, covering free iron, nickel-iron and iron sulfides,
with TG-data we can estimate the oxidable part of the total iron.
The term "oxidable" refers here to temperatures not exceeding
1000°C. We received :

| | Y-74013 | ALH-765 | Y-74450 | Y-7308 | Y-75102 |
|-------------------|---------|---------|---------|--------|---------|
| Fe total wt% | 13.77 | 16.42 | 15.21 | 13.45 | 22.24 |
| mass increase wt% | 0.64 | 1.4 | 2.6 | 2.6 | 2.1 |
| Fe oxidized % | 3.1 | 6.06 | 11.42 | 12.92 | 6.26 |

For Derrick Peak-78007 iron the mass increase as low as ~3.5%
proves by far incomplete oxidation during heating in air. Simi-
lar result was received by us for the Sikhote Alin' iron (3.88%).

The effects of oxidation processes can often be better identi-
fied by comparing the DTA-curves for heating in air with those
as obtained for heating in oxidation-suppressing atmosphere of

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argon. Unfortunately in the latter case the TG-data were unavailable. Meandering of the DTA-curves is another feature of the applied thermoanalytical techniques making difficult the analysis of the curves.

Thermoanalytical method can be helpful in determining the degree of weathering of meteoritic material. With this purpose it was applied by Gooding [1981]. Weathering results in appearance of mineral forms which at least partially volatilize even at non-elevated temperatures. In the case of the Antarctic meteorites such behavior of meteoritic material is not observed. The thermogravimetric losses are small - they do not differ from those of non-Antarctic meteorites. However, in the case of the Yamato diogenites -74010 and -74013 we analyzed samples stored without any special precaution in test tubes for a couple of years: we obtained thermoanalytical curves remarkably changed [see Lang et al., 1983]. This observation seems to argue that natural conditions in Antarctica where the meteorites were found do not favour significantly their weathering. Naturally, such a conclusion needs further examination of Antarctic meteorites accounting the problem.

A distinct behaviour during heating in air was identified in the case of the Yamato-74662 carbonaceous chondrite C 2. Heated in air it lost rather smoothly ~9.3% of its original mass. We attributed these thermogravimetric losses to joint volatilization of water and carbon compounds. An unique feature of this meteorite is seen on the DTA-curve for heating in argon. The remarkable exothermic peak at 686°C - similar in shape to oxidation peaks - should be referred presumably to formation of a new mineral form possibly of remnants of phyllosilicates affected by heating while being a major component of the original meteorite.

In Fig.1 and 2 are given the thermoanalytical curves for Yamato-74013 diogenite and Yamato-7308 howardite respectively. In Fig.3 is demonstrated the effect of storage of powdered diogenite Yamato-74010 for two years in a test tube. In Fig.4a and 4b are shown the curves for the Yamato-74662 for heating in argon and in air respectively.

References :

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